



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Shujin Zhang et al.  
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FILING DATE: December 20, 2000  
TITLE: METHOD AND SYSTEM FOR PROVIDING NETWORK ACCESS TO  
PPP CLIENTS  
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**CERTIFICATE OF MAILING**

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**BRIEF FOR APPELLANT**

Dear Sir:

This appeal is from the decision of the Primary Examiner dated **March 9, 2005**, finally rejecting Claims 1-59, which are reproduced as an Appendix to this brief.

Two extra copies of this brief are being filed herewith. Thus, this paper is being submitted in triplicate.

The Commissioner is hereby authorized to charge any appropriate fees under 37 C.F.R. §§ 1.16, 1.17, and 1.21 that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-1698.

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**I. Real Party in Interest**

The present application is assigned to Cisco Technology, Inc.

**II. Related Appeals and Interferences**

The legal representative and assignee do not know of any other appeal or interferences which will affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

**III. Status of Claims**

Claim 1-59 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia (U.S. Patent No. 5,918,019) in view of Puthiyandyil (U.S. Patent No. 6,763,018) and in further view of Heimendinger (U.S. Patent No. 6,278,532).

**IV. Status of Amendments**

No amendments have been made after the final rejection dated March 9, 2005.

**V. Summary of the Invention**

Computer networking capabilities of a home personal computer (PC) are typically provided by telephone companies (Telcos) or commercial Internet Service Providers (ISPs) who operate network access points along the information superhighway. It is through these network access points that the user is able to connect with public domains, such as the Internet, and private domains, such as an intra-company computer network of the user's employer.

In wholesale Internet access environment, the network access provider (NAP) and the network service provider (NSP) are not necessarily the same entity. Telcos and other wholesale ISPs are typical NAPs, who operate gateways (network access servers, access routers, or the like) in their points of presence (PoPs), and provide local loop access services to PCs. NSPs are typically the customers of NAPs, who are allowed to use the NAPs' gateways to provide their Internet Protocol (IP)-based services, such as Internet access, network access, or voice over IP (VoIP) services to the PCs.

However, as NAPs, especially Telcos, are facing increasing competitive pressure to lower pricing on their wholesale services, and ISPs are providing voice and video services over IP, Telcos are battling to enter IP-based service markets. The current Point-to-Point Protocol (PPP) forwarding based on the tunneling technology, however, deprives the possibility for Telcos to offer IP-based services to their PPP clients, since the Telcos do not terminate PPP sessions and thus cannot touch IP frames.

There are other service architectures, typically the PPP Terminated Aggregation (PTA), which allows Telcos to provide IP-based services to their PPP clients. In the typical PTA, a NAP terminates PPP sessions from PCs and then forwards IP traffic to its destination via a PVC/ATM connection. Currently, it is possible for the NAP's single NAS to provide both L2TP and PTA services, and let NSPs to choose the service they prefer. Thus, by coordinating with NSPs, Telcos are able to provide IP-based services to its PPP clients. However, once a NSP chooses the L2TP service from the NAP, the NAP has no means to provide IP-based services to PPP clients who are accessing the NSP. Since PPP clients are typically subscribers of the NSP's services and thus "owned" by the NSP, this is the most likely scenario.

Furthermore, in a situation where a NAP offers both L2TP and PTA services, there still remains inconvenience for users to select the services in the PPP-based network access. In order to select another service from the NAS, such as connection to a Home Gateway (HGW) of a different network, the PPP client must terminate the existing PPP session and establish a new PPP connection to the NAS, since The L2TP connects a PPP client only to a single destination L2TP network server (LNS).

## **VI. The Issue**

The issue is whether Claims 1-59 are rendered obvious over Valencia in view of Puthiyandyil and in further view of Heimendinger.

## **VII. Grouping of Claims**

Claims 1, 19, 33, 41, and 59 are independent claims and as such are separately patentable and are argued separately below. Claims 2-18 stand or fall with independent Claim 1 from which they depend; Claims 20-32 stand or fall with independent Claim 19 from which they depend; Claims 34-40 stand or fall with independent Claim 33 from which they depend; and Claims 42-58 stand or fall with independent Claim 41 from which they depend.

## **VIII. Arguments**

### **A. Claim 1**

Claim 1 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia in view of Puthiyandyil and in further view of Heimendinger.

Claim 1 recites, in pertinent part:

setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;

creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, and an egress PPP object associated with said Layer 2 tunnel;

creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;

...

linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

Valencia and the Background Art described in the current application are substantially the same, that is, Valencia is an example of the prior art shown in FIG. 1 and described on page 1, line 15 through page 5, line 17 of the specification. Valencia does not provide for a Layer 2 tunnel and some other link at the same time as claimed in Claim 1. This is emphasized by Valencia with respect to steps 46, 48, and 50 of FIG. 4 where a choice has to be made by the remote client for one or the other and not both virtual dial-up service or standard access to the Internet (See. Col. 4, lines 58-65, among others). Further, Valencia fails to provide the NAS a termination mechanism once tunneling has been established from the PPP of the remote client to the PPP of the HGW as illustrated in Fig. 2. (See, col. 14, lines 24-33).

Puthiyandyil also does not teach a Layer 2 tunnel for a client nor does Puthiyandyil provide for a Layer 2 tunnel and some other link at the same time as claimed in Claim 1. Rather, Puthiyandyil provides for a generic tunnel between a modem and a route server. The route server utilizes the tunnel to provide routing information to the local modem, so that the modem may perform distributed routing through its IP distributed forwarding entity (see Col. 8, line 25 through Col. 9, line 45). However, the tunnel itself is not for the client.

The alleged combination of Valencia and Puthiyandyil would not result in the claimed invention. The “mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.” (MPEP §2143.01). Additionally, a “statement that modifications of the prior art to meet the claimed invention would have been ‘well within the ordinary skill of the art’ at the time the claimed invention was made’ because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reasons to combine the teachings of the references.” (MPEP §2143.01). The Patent Office has attempted to take a first reference, which teaches element A, and combine it with a second reference that teaches element B, which is an alternative to element A, in order to arrive at a teaching of both elements A and B. However, the combination of the first and second references does not result in a teaching of element A and B. Rather, such a combination would teach the use of element A or B, which does not result in the claimed invention.

As an example, suppose a first reference teaches a car with a 6-cylinder engine, whereas a second reference teaches a car with a 4-cylinder engine. The combination of the two references

would teach a car with either a 6-cylinder engine or a 4-cylinder engine, but would NOT teach a car with two engines. Such a teaching would require one of the two references to teach or suggest the use of multiple engines in the same car.

In the present application, the Office Action cites Valencia as a network providing a Layer 2 tunnel and Puthiyandyil as a network providing another link. However, neither Valencia, Puthiyandyil, nor their combination teach or suggest the presence of BOTH a Layer 2 tunnel for the client and another link at the same time. The Patent Office has failed to indicate a basis for such an alleged teaching despite multiple opportunities to do so in response to applicant's previous arguments. Accordingly, applicant respectfully asserts that there is no suggestion or motivation to combine Valencia with Puthiyandyil.

Moreover, the alleged combination would be unsuitable for the stated purpose, as it would require a choice to be made by the remote client for either a virtual dial-up service or standard access to the Internet, but not both. Should the remote client choose a virtual dial-up service, a Layer 2 tunnel would not be provided for the client. Additionally, the alleged combination of Valencia and Puthiyandyil would require the termination of any Layer 2 tunnel created for the client before providing IP-based services for the client through another link. Accordingly, neither Valencia, Puthiyandyil, nor their combination teach forwarding packets from a client over BOTH a Layer 2 tunnel for the client and another link.

Additionally, the Office Action cites col. 7, lines 15-32 and col. 16, lines 32-67 of Heimendinger as teaching the creation of an ingress PPP object, host object, egress PPP object, and egress IP object, and their linking. However, Heimendinger does not reflect any sort of



indication of two different types of egress objects (an egress PPP object and an egress IP object). Heimendinger speaks only generically about destination objects which are based on determined destinations. There is no teaching or indication that these destinations represent different types of connections, let alone a Layer 2 tunnel and a non-Layer 2 tunnel. The Office Action itself corresponds a session object of Heimendinger with an egress PPP object, but provides no such corresponding object in Heimendinger to an egress IP object. As can be seen from FIG. 4 of the present application, the egress PPP object 37 may contain a connection object 61, aggregation object 63, and a tunnel object 65, while an egress IP object 39 may contain a connection object 67 and a service object 69. While this is merely an example of an egress PPP object and egress IP object, applicant maintains that it is clear that the egress PPP object and egress IP object are different types of objects, one allowing a connection through a Layer 2 tunnel and the other through a non-Layer 2 tunnel. Heimendinger shows no such distinction.

The Office Action argues that:

“Valencia, Puthiyandyil and Heimendinger disclose substantially the invention as broadly claimed. ...Applicants are interpreting the claims very narrow using the specification without considering the broad teaching of the reference stated in the rejection. Applicants are reminded that the test for obviousness is not whether the features of one reference may be bodily incorporated not the other to produce the claimed subject matter but simply what the combination of the references makes obvious to one of ordinary skill in the pertinent art.” (Final Rejection, page 21 and 22)

The Office Action cites numerous cases to support the position that the “test for combining references is what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art.” (Final Rejection, page 22-23) Additionally, the Office Action further remarked that “per Applicant’s arguments that all claim limitations be taught or suggested by the prior art, Applicants appear to misinterpret the guidance given under MPEP 2142. In particular,

references are evaluated by what they suggest to one versed in the art, rather than by their specific disclosure.” (Final Rejection, page 23). Applicants respectfully disagree.

The Office Action is correct in stating that MPEP §2142 provides that “the examiner must step backward in time and into the shoes worn by the hypothetical ‘person of ordinary skill in the art’ when the invention was unknown and just before it was made”. However, upon further reading of MPEP §2142, it further states that the above criteria is to prevent the examiner from a “tendency to resort to ‘hindsight’ based upon applicant’s disclosure [which] is often difficult to avoid due to the very nature of the examination process.” MPEP §2142.

Additionally, MPEP §2142 also requires that:

To establish a *prima facie* case of obviousness, three basic criteria must be met. **First there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant’s disclosure. (emphasis added)

These criteria are further discussed in MPEP §2143. Thus, the ordinary skill in the art standard is applied in light of the three criterias set forth in MPEP §2142. Applicant has consistently set forth and applied the requirements under MPEP §2142, as discussed above and in Applicant’s previous Responses.

Thus, for the reasons discussed above, the alleged combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render Claim 1 obvious because there is no reasonable expectation that the combination of prior art references would result in the

claimed invention and the prior art references do not teach or suggest all the limitations of Claim

1. For these reasons, Claim 1 should be allowed.

**B. Claim 19**

Claim 19 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia in view of Puthiyandyil and in further view of Heimendinger.

Claim 19 recites, in pertinent part:

a first interface for receiving a PPP session creation request from a client, said PPP session creation request including a control protocol frame encapsulated therein;

a second interface for forwarding data packets from a PPP session over a Layer 2 tunnel;

a third interface for forwarding IP frames over a link other than said Layer 2 tunnel; ...

a processor coupled with said first interface, said second interface, said third interfaces, and said memory, said processor including:

a domain information determiner for obtaining user domain information associated with said PPP session creation request;

an object generator for creating objects in said memory, said object generator creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, an egress PPP object associated with Layer 2 tunneling through said second interface, and an egress IP object associated with IP-based forwarding through said third interface, said egress IP object being created based upon obtained user domain information;

a PPP session forwarder for setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame, and for linking said ingress PPP object, said host object, and said egress PPP object, thereby forwarding data packets from a PPP session with said client over said Layer 2 tunnel; and

an IP frame forwarder for linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

Claim 19 provides for similar elements as Claim 1. Thus, the same arguments with reference to Claim 1 would apply. Therefore, for the reasons discussed above, the alleged

combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render Claim 19 obvious because there is no reasonable expectation that the combination of prior art references would result in the claimed invention and the prior art references do not teach or suggest all the limitations of Claim 19. For these reasons, Claim 19 should be allowed.

**C. Claim 33**

Claim 33 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia in view of Puthiyandyil and in further view of Heimendinger.

Claim 33 recites, in pertinent part:

an IP frame forwarding interface;

a memory, said memory containing:

an ingress PPP object associated with said PPP session receiving interface;

a host object associated with a client requesting network access;

an egress PPP object associated with said PPP session Layer 2 tunneling interface; and

an egress IP object associated with said IP frame forwarding interface; and

a processor coupled with said PPP session receiving interface, said PPP session Layer 2 tunneling interface, said IP frame forwarding interface, and said memory

Claim 33 provides for similar elements as Claim 1. Thus, the same arguments with reference to Claim 1 would apply. Therefore, for the reasons discussed above, the alleged combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render Claim 33 obvious because there is no reasonable expectation that the combination of prior art references would result in the claimed invention and the prior art references do not teach or suggest all the limitations of Claim 33. For these reasons, Claim 33 should be allowed.

**D. Claim 41**

Claim 41 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia in view of Puthiyandyil and in further view of Heimendinger.

Claim 41 recites, in pertinent part:

means for setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;

means for creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, an egress PPP object associated with said Layer 2 tunnel;

means for creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;

...

means for linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

Claim 41 provides for similar elements as Claim 1. Thus, for the reasons discussed above, the alleged combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render Claim 41 obvious because there is no reasonable expectation that the combination of prior art references would result in the claimed invention, and the prior art references do not teach or suggest all the limitations of Claim 41. For these reasons, Claim 41 should be allowed.

**E. Claim 59**

Claim 59 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Valencia in view of Puthiyandyil and in further view of Heimendinger.

Claim 59 recites:

setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;

creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, and an egress PPP object associated with said Layer 2 tunnel;

creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;

...

linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

Claim 59 provides for similar elements as Claim 1. Thus, for the reasons discussed above, the alleged combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render Claim 59 obvious because there is no reasonable expectation that the combination of prior art references would result in the claimed invention and the prior art references do not teach or suggest all the limitations of Claim 59. For these reasons, Claim 59 should be allowed.

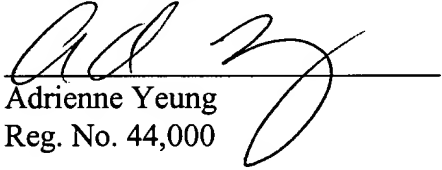
**IX. Conclusion**

In conclusion, the alleged combination of Valencia in view of Puthiyandyil and in further view of Heimendinger would not render the claimed invention obvious because there is no suggestion or motivation to combine reference teachings to obtain the claimed invention, no reasonable expectation that the combination of prior art references would result in the claimed invention, and the prior art references do not teach or suggest all the limitations of the claims. In rejecting the claims, the Patent Office should evaluate the references by what they suggest to one of ordinary skill in the art, however, this standard is applied in light of the three criterias clearly set forth in MPEP §§2142 and 2143 in order to establish a prima facie case of obviousness. Accordingly, the prior art references which have been applied by the Office Action do not render the claimed invention obvious and Claims 1-59 should be allowed.

Dated: 4/29/05

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**APPENDIX**

**The Appealed Claims**

1. (Previously Presented) A method for providing computer network access, comprising:  
  
receiving a PPP session creation request from a client, said PPP session creation request including a control protocol frame encapsulated therein;  
  
obtaining user domain information associated with said PPP session creation request;  
  
setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;  
  
creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, and an egress PPP object associated with said Layer 2 tunnel;  
  
creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;  
  
linking said ingress PPP object, said host object, and said egress PPP object, thereby forwarding data packets from a PPP session with said client over said Layer 2 tunnel; and  
  
linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.
2. (Original) The method according to claim 1, wherein said setting up includes forwarding control protocol negotiations.
3. (Original) The method according to claim 1, further including:  
  
receiving an IP address through said Layer 2 tunnel, said IP address having been assigned to said client; and  
  
transferring said IP address to said client.



4. (Original) The method according to claim 1, wherein said user domain information is obtained from said PPP session creation request.
5. (Original) The method according to claim 1, wherein said user domain information is obtained using a user profile.
6. (Original) The method according to claim 1, wherein said user domain information is obtained from user identification information associated with a physical connection of said PPP session creation request.
7. (Original) The method according to claim 6, wherein said user domain information is obtained from a line number used by said client for transmitting said PPP session creation request.
8. (Original) The method according to claim 1, wherein said user domain information is obtained from user identification information associated with a physical location of said client.
9. (Original) The method according to claim 1, further comprising:  
maintaining a forwarding information base for said host object, said forwarding information base containing at least one association between a network address and either said ingress PPP object or said egress PPP object.
10. (Original) The method according to claim 9, wherein said forwarding information base includes a default link to said egress PPP object.

11. (Original) The method according to claim 9, wherein said forwarding information base is stored in the form of a hash table.

12. (Original) The method according to claim 1, wherein said creating an ingress PPP object includes creating an access PPP object associated with a PPP connection to said client via a first interface.

13. (Original) The method according to claim 12, wherein said creating an egress PPP object includes:

- creating a first connection object containing a range of IP addresses;
- creating an aggregation PPP object associated with outgoing PPP frames; and
- creating a tunnel object associated with Layer 2 tunneling through a second interface.

14. (Original) The method according to claim 13, wherein said first connection object includes a list of network addresses.

15. (Original) The method according to claim 13, wherein said creating an egress IP object includes:

- creating a second connection object containing a range of IP addresses; and
- creating a service object associated with IP frame forwarding through a third interface.

16. (Original) The method according to claim 15, wherein said second connection object includes a list of network addresses.

17. (Original) The method according to claim 15, further comprising maintaining a forwarding information base for said host object, said forwarding information base containing:

an association between said access PPP object and an address of said client; and  
a default link to said aggregation PPP object.

18. (Original) The method according to claim 17, wherein

said creating said first connection object includes adding into said forwarding information base an association between said aggregation PPP object and a corresponding network address,  
and

said creating said second connection object includes adding into said forwarding information base an association between said service object and a corresponding network address.

19. (Previously Presented) A network device for providing computer network access, said network device comprising:

a first interface for receiving a PPP session creation request from a client, said PPP session creation request including a control protocol frame encapsulated therein;

a second interface for forwarding data packets from a PPP session over a Layer 2 tunnel;

a third interface for forwarding IP frames over a link other than said Layer 2 tunnel;

a memory; and

a processor coupled with said first interface, said second interface, said third interfaces,  
and said memory, said processor including:

a domain information determiner for obtaining user domain information  
associated with said PPP session creation request;

an object generator for creating objects in said memory, said object generator creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, an egress PPP object associated with Layer 2 tunneling through said second interface, and an egress IP object associated with IP-based forwarding through said third interface, said egress IP object being created based upon obtained user domain information;

a PPP session forwarder for setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame, and for linking said ingress PPP object, said host object, and said egress PPP object, thereby forwarding data packets from a PPP session with said client over said Layer 2 tunnel; and

an IP frame forwarder for linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

20. (Original) The network device according to claim 19, wherein said ingress PPP object includes an access PPP object associated with a PPP connection with said client via said first interface.

21. (Original) The network device according to claim 19, wherein said egress PPP object includes:

a PPP session connection object containing a range of IP addresses;  
an aggregation PPP object associated with outgoing PPP frames; and  
a tunnel object associated with Layer 2 tunneling through said second interface.

22. (Original) The apparatus according to claim 19, wherein said egress IP object includes:  
an IP frame connection object containing a range of IP addresses; and  
a service object associated with IP frame forwarding through said third interface.
23. (Original) The network device according to claim 19, wherein said PPP session forwarder forwards control protocol negotiations when setting up said Layer 2 tunnel.
24. (Original) The network device according to claim 19, wherein said PPP session forwarder includes:  
an IP address forwarder for receiving an IP address through said Layer 2 tunnel, said IP address having been assigned to said client, and for transferring said IP address to said client.
25. (Original) The network device according to claim 19, wherein said domain information determiner obtains said user domain information from said PPP session creation request.
26. (Original) The network device according to claim 19, wherein said domain information determiner obtains said user domain information using a service profile.
27. (Original) The network device according to claim 19, wherein said domain information determiner obtains said user domain information from user identification information associated with a physical connection of said PPP session creation request.

28. (Original) The network device according to claim 27, wherein said domain information determiner obtains said user domain information from a line number used by said client for transmitting said PPP session creation request.

29. (Original) The network device according to claim 19, wherein said domain information determiner obtains said user domain information from user identification information associated with a physical location of said client.

30. (Original) The network device according to claim 19, further comprising:  
a forwarding information base provided for said host object, said forwarding information base containing at least one association between a network address and either said ingress PPP object or said egress PPP object.

31. (Original) The network device according to claim 30, wherein said forwarding information base includes a default link to said egress PPP object.

32. (Original) The network device according to claim 30, wherein said forwarding information base is stored in the form of a hash table.

33. (Original) An apparatus for providing computer network access, said apparatus comprising:

- a PPP session receiving interface;
- a PPP session Layer 2 tunneling interface;
- an IP frame forwarding interface;

a memory, said memory containing:

an ingress PPP object associated with said PPP session receiving interface;

a host object associated with a client requesting network access;

an egress PPP object associated with said PPP session Layer 2 tunneling interface; and

an egress IP object associated with said IP frame forwarding interface; and

a processor coupled with said PPP session receiving interface, said PPP session Layer 2 tunneling interface, said IP frame forwarding interface, and said memory, said processor including:

a user domain information determiner;

an object generator responsive to said user domain information determiner;

a PPP session forwarder linking through said ingress PPP object, said host object, and said egress PPP object; and

an IP frame forwarder linking through said host object and said egress IP object.

34. (Original) An apparatus according to claim 33, further comprising:

a forwarding information base associated with said host object, said forwarding information base containing at least one association between a network address and either said ingress PPP object or said egress PPP object.

35. (Original) The apparatus according to claim 34, wherein said forwarding information base is stored in the form of a hash table in said memory.

36. (Original) The apparatus according to claim 34, wherein said forwarding information base includes a default link to said egress PPP object.
37. (Original) The apparatus according to claim 36, wherein said forwarding information base further includes an association between said egress IP object and a corresponding network address.
38. (Original) The apparatus according to claim 33, wherein said ingress PPP object includes an access PPP object associated with a PPP connection to said client via said PPP session receiving interface.
39. (Original) The apparatus according to claim 33, wherein said egress PPP object includes:
- a PPP session connection object containing a range of IP addresses;
  - an aggregation PPP object associated with outgoing PPP frames; and
  - a tunnel object associated with Layer 2 tunneling through said PPP session Layer 2 tunneling interface.
40. (Original) The apparatus according to claim 33, wherein said egress IP object includes:
- an IP frame connection object containing a second range of IP addresses; and
  - a service object associated with IP frame forwarding through said IP frame forwarding interface.



41. (Previously Presented) A system for providing computer network access, comprising:
- means for receiving a PPP session creation request from a client, said PPP session creation request including a control protocol frame encapsulated therein;
  - means for obtaining user domain information associated with said PPP session creation request;
  - means for setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;
  - means for creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, an egress PPP object associated with said Layer 2 tunnel;
  - means for creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;
  - means for linking said ingress PPP object, said host object, and said egress PPP object, thereby forwarding data packets from a PPP session with said client over said Layer 2 tunnel; and
  - means for linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.

42. (Original) The system according to claim 41, wherein said means for setting up includes means for forwarding control protocol negotiations.

43. (Original) The system according to claim 41, further including:
- means for receiving an IP address through said Layer 2 tunnel, said IP address having been assigned to said client; and
  - means for transferring said IP address to said client.

44. (Original) The system according to claim 41, wherein said user domain information is obtained from said PPP session creation request.

45. (Original) The system according to claim 41, wherein said user domain information is obtained using a user profile.

46. (Original) The system according to claim 41, wherein said user domain information is obtained from user identification information associated with a physical connection of said PPP session creation request.

47. (Original) The system according to claim 46, wherein said user domain information is obtained from a line number used by said client for transmitting said PPP session creation request.

48. (Original) The system according to claim 41, wherein said user domain information is obtained from user identification information associated with a physical location of said client.

49. (Original) The system according to claim 41, further comprising:  
means for maintaining a forwarding information base for said host object, said forwarding information base containing at least one association between a network address and either said ingress PPP object or said egress PPP object.

50. (Original) The system according to claim 49, wherein said forwarding information base includes a default link to said egress PPP object.

51. (Original) The system according to claim 49, wherein said forwarding information base is stored in the form of a hash table.
52. (Original) The system according to claim 41, wherein said ingress PPP object includes an access PPP object associated with a PPP connection to said client via a first interface.
53. (Original) The system according to claim 52, wherein said egress PPP object includes:  
a first connection object containing a range of IP addresses;  
an aggregation PPP object associated with outgoing PPP frames; and  
a tunnel object associated with Layer 2 tunneling through a second interface.
54. (Original) The system according to claim 53, wherein said first connection object includes a list of network addresses.
55. (Original) The system according to claim 53, wherein said egress IP object includes:  
a second connection object containing a range of IP addresses; and  
a service object associated with IP frame forwarding through a third interface.
56. (Original) The system according to claim 55, wherein said second connection object includes a list of network addresses.
57. (Original) The system according to claim 55, further comprising means for maintaining a forwarding information base for said host object, said forwarding information base containing:

an association between said access PPP object and an address of said client; and  
a default link to said aggregation PPP object.

58. (Original) The system according to claim 57, wherein

said means for creating said first connection object includes means for adding into said forwarding information base an association between said aggregation PPP object and a corresponding network address, and

said means for creating said second connection object includes means for adding into said forwarding information base an association between said service object and a corresponding network address.

59. (Previously Presented) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a system for providing computer network access, the system including:

receiving a PPP session creation request from a client, said PPP session creation request including a control protocol frame encapsulated therein;

obtaining user domain information associated with said PPP session creation request;

setting up a Layer 2 tunnel for said client according to a parameter contained in said control protocol frame;

creating an ingress PPP object associated with an incoming PPP session, a host object associated with said client, and an egress PPP object associated with said Layer 2 tunnel;

creating an egress IP object based upon obtained user domain information, said egress IP object associated with IP-based forwarding;

linking said ingress PPP object, said host object, and said egress PPP object, thereby forwarding data packets from a PPP session with said client over said Layer 2 tunnel; and linking said host object and said egress IP object, thereby forwarding IP frames received from said client over a link other than said Layer 2 tunnel.